Department of Environment & Conservation

TENNESSEE USTs APPROACH TO POTENTIAL VAPOR INTRUSION ISSUES

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April 21, 2016

WHY THE INTEREST?

- Vapor intrusion issues have received national attention with many state and EPA work groups developing guidance documents
- Vapor intrusion predictions are available from existing air models but their built-in assumptions are very conservative
- Models are just that – predictors and best educated guesses
- Looking for a better way to scientifically defend site risk investigations and/or site closures

TN UST's APPROACH

- In January 2005, TN-UST implemented a full scale RBCA program (previously three different processes with different outcomes)
- After a year or so, observed that a large volume of sites failed the risk model for volatilization to indoor air pathway
- "Failure" mostly attributed to the conservative approach used by TN-UST to always consider an on-site commercial worker receptor (May be too conservative….)

IS A FAIL REALLY A FAIL?

After evaluating the data from several sites that failed, we wondered:

- Are there any trends that could be observed?
- What is the effect of depth to contamination relative to potential VI?
- Is there any correlation between contaminant concentration relative to approved Site-specific Clean-up Levels (SSCLs)?
- Just because a site “fails” the risk calculation (i.e. modeling) is it REALLY a risk?

Decision made to develop a process to further investigate potential vapor intrusion pathways

INVESTIGATE THE FAILS?

A committee was formed that:

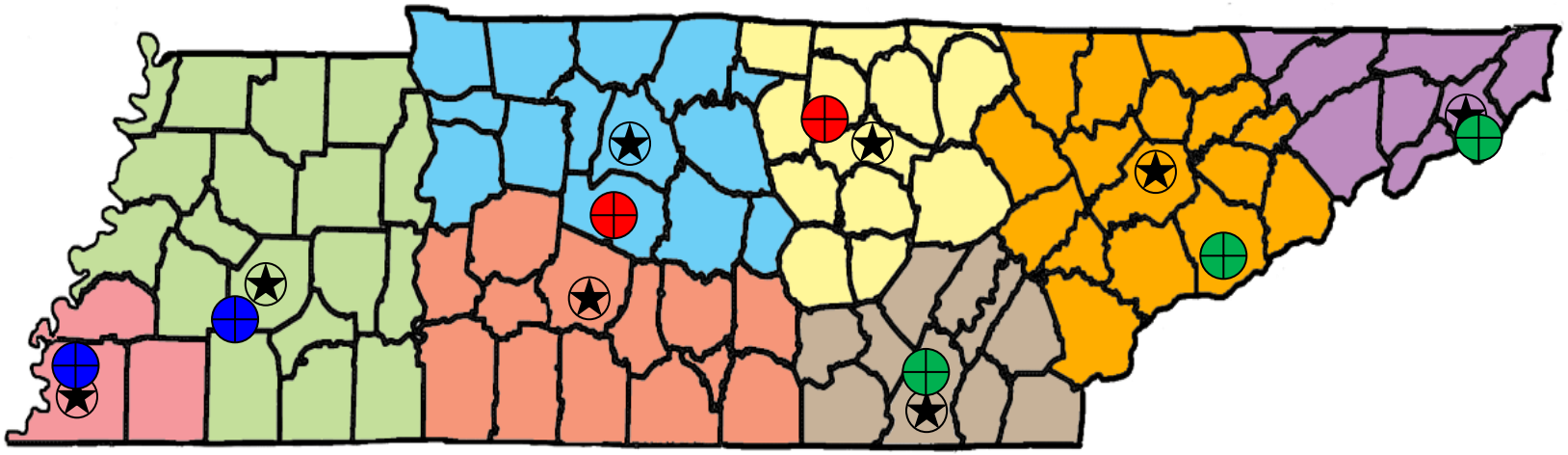
- Reviewed existing state, EPA and work group guidance
- Attended multiple training classes conducted by nationally recognized experts
- Coordinated and attended a PEER match with Utah UST
- Developed a draft guidance document (TGD-018 Requirements for Conducting Soil Gas Surveys)
- Reviewed contamination cases across the state that had failed the risk calculation for volatilization to indoor air

SEVEN PILOT PROJECTS SELECTED

Two sites in west Tennessee

Two sites in middle Tennessee

Three sites in east Tennessee



PILOT PROJECT OBJECTIVES

- Define field process, determine type of equipment and materials of construction
- Determine the effects, if any, of multi-depth samples
- Compare actual in-situ concentrations to calculated values
- Identify areas of confusion in the draft guidance document

PILOT PROJECT RESULTS

- Nylon tubing preferable. Tracer often permeated thru polypropylene.
- Plastic quick connect fittings preferable to brass compression. Brass often distorted and allowed vacuum loss/leakage.
- Isopropanol better tracer material. Applying DFE/Freon confused contractors.
- Did not identify significant differences in vapor concentrations versus depth (limited data)
- Five of seven projects were closed with no additional data collection or monitoring (71%)

LESSONS LEARNED

- Take more sample canisters than there are sample locations
- Pre-assemble sample trains prior to arriving on site
- Conduct vacuum test on sample trains – both when assembled and immediately before use
- Isolate the sample train from the tracer material
- Require laboratory measurement of O_2 and CO_2 (field measurements give false positives)
- Hammer drill is more cost effective and is better for tight spots than direct push

CORE COMPONENTS

- Sample depths (3’ vs. 10’) are based on receptor type sub-slab, crawl space or basement)
- A single sampling event is conducted versus long term monitoring (up to 8 points w/Division approval)
- Each sample train is vacuum tested and is comprised of nylon tubing and plastic quick connects
- Each sampling point is sealed at the surface with petroleum-free modeling clay or hydrated bentonite
- 1 liter Summa canisters are utilized for sample collection

CORE COMPONENTS

- Sample collection must be completed within 30 minutes
- **ONLY** COCs that fail the risk calculation are to be analyzed
- Approved for use at sites where groundwater is deeper than 3
- Temporary wells are installed versus permanent wells
- **NO** collection of sub-slab or indoor air without prior central office approval

TENNESSEE LOOK-UP TABLE

(Only Benzene and Toluene depicted)

Enter vertical distance from crawlspace or slab to sample point, or horizontal distance from basement wall to sample point

3

Benzene Soil Gas Limits				
Receptor/Foundation Type	**µg/m^3**	**ppbv**	**ppmv**	**Sample Depth**
Commercial (Slab)	13818	4246	4.25	3ft (0.9144m)
Residential (Slab)	2414	742	0.74	
Commercial (Basement/Crawlspace)	5901	1813	1.81	
Residential (Basement/Crawlspace)	1361	418	0.42	
Commercial (Basement/Slab)	10477	3219	3.22	
Residential (Basement/Slab)	3134	963	0.96	

Toluene Soil Gas Limits				
Receptor/Foundation Type	**µg/m^3**	**ppbv**	**ppmv**	**Sample Depth**
Commercial (Slab)	1629660	500728	500.73	3ft (0.9144m)
Residential (Slab)	167850	51574	51.57	
Commercial (Basement/Crawlspace)	735353	225944	225.94	
Residential (Basement/Crawlspace)	96381	29614	29.61	
Commercial (Basement/Slab)	1281723	393821	393.82	
Residential (Basement/Slab)	108030	33193	33.19	

UST RESULTS TO DATE

- Total of 169 soil gas surveys have been conducted at UST sites to investigate potential vapor intrusion pathway
- 139 investigations indicated no concentrations of concern
- 30 investigations have indicated there **<u>may be</u>** a potential for concern for VI
(therefore active clean-ups conducted)
- **82%** of petroleum contaminated sites were closed after the results of the SGS were received with no additional data collection or monitoring

UPCOMING REVISIONS

- Currently evaluating our risk program:
  - ✓ All Chemicals of Concern
  - ✓ Evaluating Biovapor and other models
  - ✓ Evaluating clean soil exclusion zone criteria
- Anticipate a draft technical document ready for stakeholder comment by fall 2016

REMEDIATION SYSTEMS PURCHASED

2008 Researched
old clean-up files

Dual phase hi vac

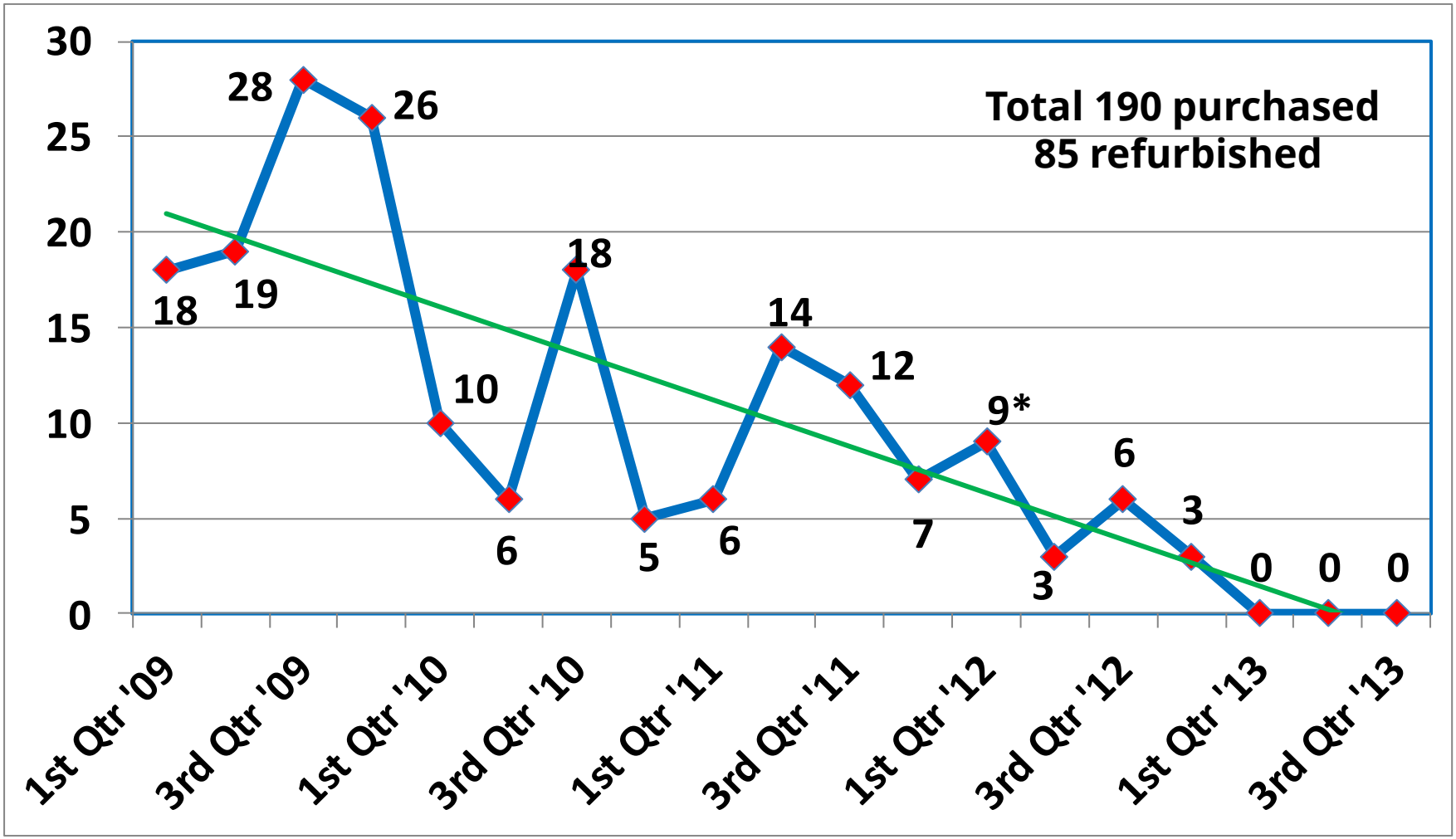
25 hp 30 hp 40 hp

15 gpm

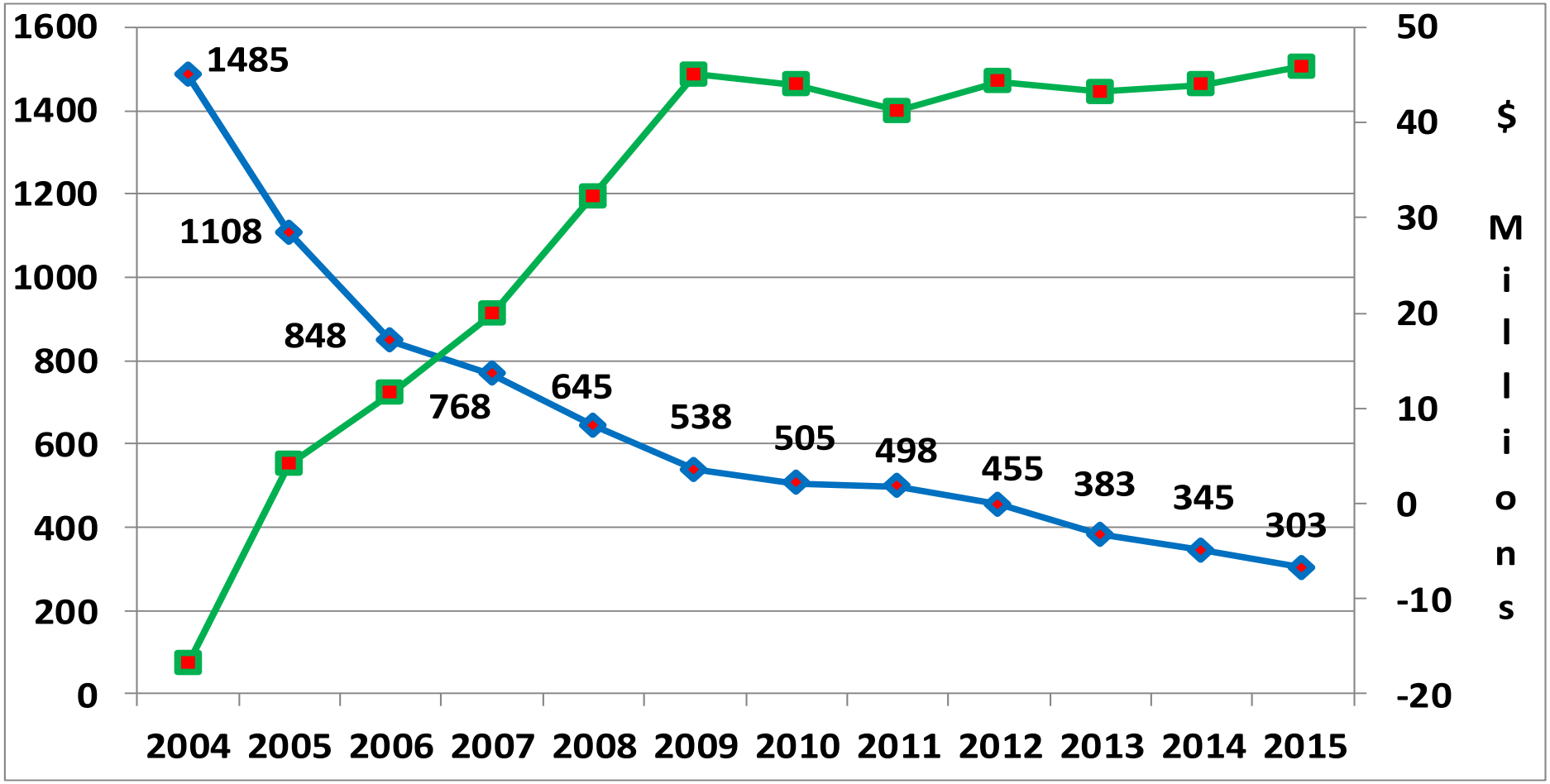
and either

Standard
or
Explosion Proof
(Memphis only)

NEW SYSTEMS PURCHASED UNDER CONTRACT



CONTAMINATION CASE REDUCTION vs. UST FUND BALANCE



CONTAMINATION SITES CLOSED WITH A STATE OWNED SYSTEM

150 Sites

33 Drinking Water

85 Measurable Product

7 Sites (both DW & Product)

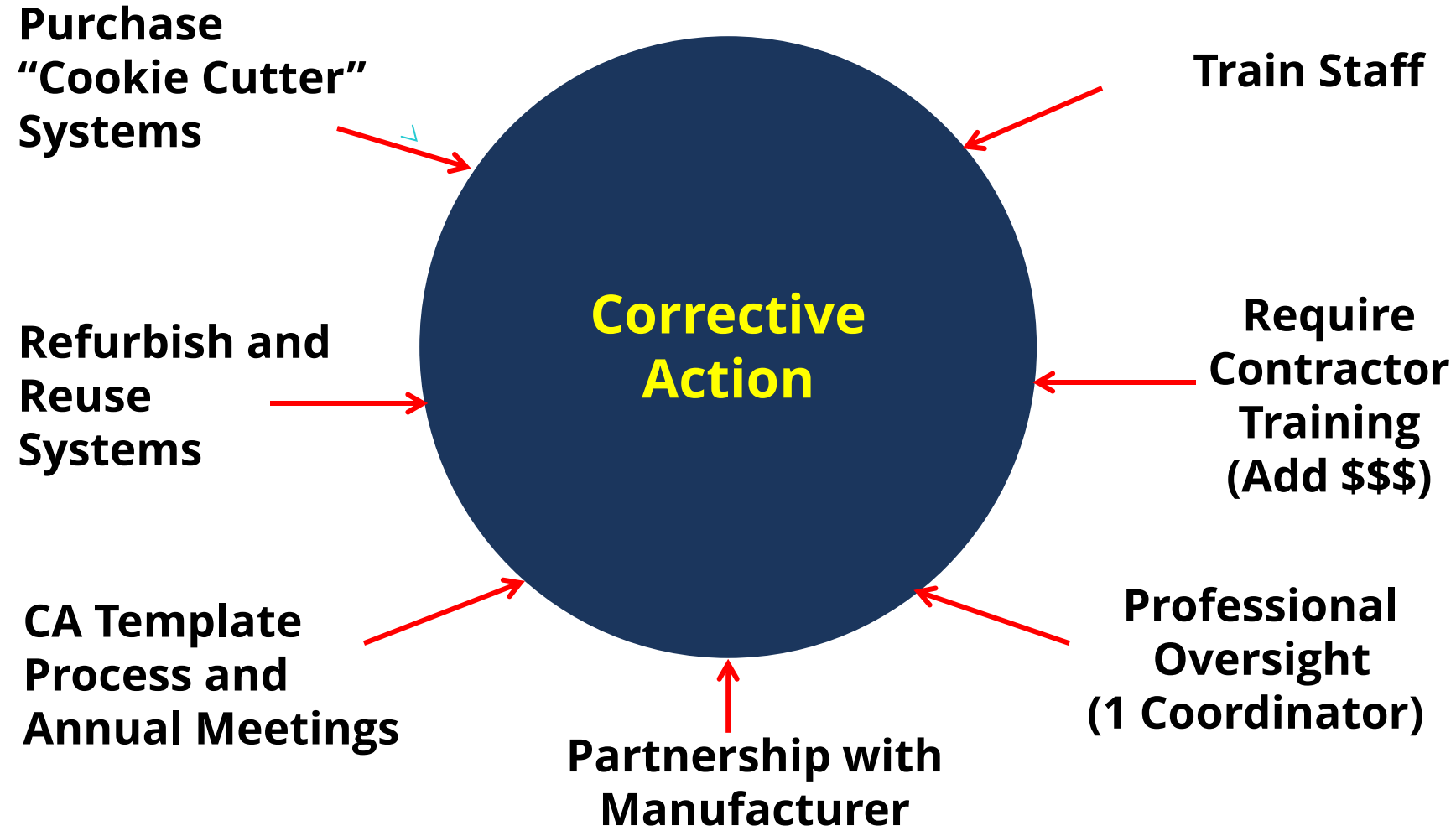
Highest risk worked first

Statewide

Avg system runtime 972 days (2.7 yrs)

Avg system start-up to case closure 1382 days (3.8 yrs)

STANDARDIZE THE PROCESS AND THE EQUIPMENT



FUND SAVINGS SINCE 2009

Systems purchased under contract (Volume discount; No 15% mark-up by CAC; No Sales tax)	$10,735,000
16 Systems donated by RPs	$1,360,000
Refurbishment and reuse	$9,143,250
Approximate Savings to Date	**$21,238,250**

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